LIMITED

WRD/MKG/INF/L.73
20 December 1961

UNITED NATIONS

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

CAMBODIA, LAOS, THAILAND AND VIET-NAM

Committee for Coordination of Investigations
of the Lower Mekong Basin.
Sixteenth Session (Plenary)
2-8 January 1962
Phnom-Penh, Cambodia

SUMMARY REVIEW OF "COMPREHENSIVE RECONNAISSANCE REPORT ON THE MAJOR TRIBUTARIES OF THE LOWER MEKONG BASIN"

Note prepared by the secretariat

Contents

		Page
I.	Development of the major tributaries	1
II.	Development of the main stem	9
III.	Secretariat recommendations	16

I. DEVELOPMENT OF THE MAJOR TRIBUTARIES

The work on the reconnaissance of major tributaries in the lower Mekong basin, carried out by a team of experts organized by the Government of Japan, was started in January 1959 and completed in September 1961 over a period of two years and nine months. Altogether 35 experts participated in reconnaissance surveys involving about 75 man-month of field work. In addition, 8 more experts were assigned to assist the team in Tokyo in the analysis of data and planning of projects. The total sum allocated to the reconnaissance survey by the Government of Japan amounted to 97 million yen or $270,000 equivalent.

In addition to three interim reports presented to the Coordination Committee previously, the team submitted a 437 page final or comprehensive report[1/] to the Committee at its 15th session in October 1961. The secretariat was requested by the Committee to prepare a summary review of the report for use by the Committee at its 16th session.

Ground survey conducted by the Reconnaissance Team in the field covered practically all major tributaries of the lower basin, totalling 30 in number, from the delta up to Pa Mong. In addition to these 30 major tributaries, the Team also included in its report 4 more tributaries located between Pa Mong and Luang Prabang over which aerial inspection was made. The 34 tributaries included in the report comprise approximately 62 per cent of the drainage area of the lower Mekong basin, or 389,570 square kilometres out of 635,000 square kilometres.

As a result of the first field survey in 1959 covering 34 tributaries, the Team singled out 16 tributaries as the more promising ones and recommended

/for early

1/ "Comprehensive Reconnaissance Report on the Major Tributaries of the Lower Mekong Basin" prepared by the Mekong Reconnaissance Team organized by the Government of Japan, Tokyo, September 1961, 347 pages plus 31 tables and 59 maps and figures.

for early development. Out of these 16 tributaries, the Committee selected 4, namely: the Stung Battambang (Cambodia), Nam Ngum (Laos), Nam Pong (Thailand), and Upper Se San (Viet-Nam) and obtained assistance from the United Nations Special Fund to carry out detailed investigations which would culminate in four comprehensive project reports suitable for negotiation of loans for construction. The Government of Japan also provided assistance in the preparation of comprehensive reports for two more tributaries, namely the Prek Thhnot (Cambodia) and Nam Gam (Thailand), and was requested by the Committee to also include the Upper Srepok (Viet-Nam) on which a hydrologic station is being established by the Team and measurements will be taken. For the Prek Thhnot project, the planning of irrigation development was promised by the Government of Israel.

Given in table 1 is a summary of the 34 tributaries investigated by the Team, the 16 promising ones recommended for early development, and the 7 already under detailed investigation[1/].

/Table 1

1/ Including the Upper Srepok

Table 1

Tributaries covered by the reconnaissance surveys

(Please refer to general map of the lower Mekong basin contained in the envelope on back of the Comprehensive Reconnaissance Report)

No.	Major tributaries		Drainage area sq km	Promising tributaries	Tributaries recommended for detailed investigation	
	34 tributaries covered by 1st survey	Method of survey		16 tributaries covered by 2nd and 3rd surveys	8 tributaries recommended by Japanese Team	Action taken by the Committee
	LAOS					
1	Nam Ou	A	25,600			
2	Nam Seng	A	6,780			
3	Nam Khan	A	7,410			
4	Nam Ngum	AG	16,000	(a) Nam Ngum (b) Nam Lik	Nam Ngum	Special Fund Project
4X	(Nam Nhiep)	A	(3,600)			
4Y	(Nam Sane)	A	(2,100)			
5	Nam Theun	AG	14,700	Nam Theun	Nam Theun	No action
6	Se Bang Fai	AG	9,550	Se Bang Fai		
7	Se Bang Hieng	AG	19,800	Se Bang Hieng		
8	Se Done	AG	7,790	Se Done		
	LAOS-THAILAND					
9	Nam Hieng	A	4,360			
	THAILAND					
10	Nam Gam	AG	3,440	Nam Gam	Nam Gam	Japanese Aid Project
11	Nam Mune & Chee	AG	117,000	(a) Lam Dom Noi (b) Chaya Poum		
12	Nam Pong	AG	(15,900)	Nam Pong	Nam Pong	Special Fund Project
13	Nam Pao	AG	(7,600)			
14	Nam Song Gram	AG	10,800			
15	Huey Bang Sai	AG	1,350			
16	Nam Mong	AG	2,390			
	CAMBODIA-LAOS					
17	Se Kong	AG	25,600			

A = Aerial inspection

G = Ground inspection

No.	Major tributaries: 34 tributaries covered by 1st survey	Method of survey	Drainage area sq km	Promising tributaries: 16 tributaries covered by 2nd and 3rd surveys	Tributaries recommended for detailed investigation: 8 tributaries recommended by Japanese Team	Action taken by the Committee
	CAMBODIA-VIETNAM					
18	Se San	AG	18,000	Upper Se San	Upper Se San (8,300)	Special Fund Project
19	Srepok	AG	30,800	Upper Srepok	Upper Srepok (7,800)	Japanese Aid Project (Hydrology only)
	CAMBODIA					
20	Prek Te	AG	4,350			
21	Prek Chhlong	AG	5,660			
22	Prek Mak Kompul	-	-			
23	Tonle Tooh	AG	-			
24	Prek Kompong Trabek	AG	-			
25	Prek Thhnot	AG	5,050	Prek Thhnot	Prek Thhnot	Japanese and Israeli Aid Project
26	Stung Pursat	AG	5,100	Stung Pursat		
27	Stung Moung (Daun Tri)	AG	4,050			
28	Stung Battambang	AG	4,520	Stung Battambang	Stung Battambang	Special Fund Project
29	Stung Mongkol Borey	AG	4,330			
30	Stung Sreng	AG	6,270			
31	Stung Siem Reap	AG	860			
32	Stung Staung	AG	3,390			
33	Stung Sen	AG	17,800	Stung Sen		
34	Stung Chinit	AG	6,820			
Total of 34 tributaries			389,570			
Total area of lower basin			635,000			
% of lower basin			62%			

A = Aerial inspection
G = Ground inspection

Regarding action to be taken on the remaining 9 of the more promising tributaries, the Team recommended that hydrologic stations be established at the respective likely dam sites and topographic maps be prepared for the reservoir and irrigable areas. Such basic engineering data are indispensable for carrying out detailed investigation or project planning. In addition, the Team also recommended that the Nam Theun be taken up for detailed investigation (including preparation of a comprehensive project report). The work involved and cost estimates for these 9 tributaries (as well as some work for the 3 tributaries taken up by Japan and Israel) are listed separately in tables 2, 3 and 4. On the average, the cost of basic data collection (hydrology and topography) is estimated at about $50,000 to $60,000 per tributary project, and the cost of detailed investigation including preparation of a comprehensive project report for one tributary project is around $300,000 to $400,000.

Table 2

Basic data required for detailed investigation of 12 promising projects (16 projects less 4 undertaken by Special Fund) as recommended by the Japanese Team

No.	Promising tributaries	Location	Number of hydrologic stations required[a]	Number of rain and evaporation gauges			Topographic mapping sq km
				Recording intensity gauge	Ordinary rain gauge	Evaporation pans	
4	Nam Lik	Laos	1	1		1	400
5	Nam Theun	Laos	1	1		1	2,000
6	Se Bang Fai	Laos	1	1		1	1,000
7	Se Bang Hieng	Laos	1	1		1	1,500
8	Se Done	Laos	1	1		1	500
10	Nam Gam	Thailand	[c]				[e]
11 (a)	Lam Dom Noi	Thailand	1	1		1	600
(b)	Chaya Poum	Thailand	[b]				[d]
19	Upper Srepok	Viet-Nam	[c]				[d]
25	Prek Thhnot	Cambodia	[c]				1,400
26	Stung Pursat	Cambodia	1	1		1	600
33	Stung Sen	Cambodia	1	1		1	7,000
	Total		8	24	(70)	24	15,000 km^2
	Estimated costs						

a/ In addition to stations already established by Harza Company under US aid programme
b/ Station already established by the Royal Irrigation Department
c/ Station already established under Japanese aid
d/ Map to be supplied under Canadian aid
e/ Map to be supplied under Japanese aid.

Table 3

Cost estimate of basic data collection for 12 promising projects as recommended by the Japanese Team

No.	Tributaries	Location	Mapping	Hydrology installation	3 years operation	Total
4	Nam Lik	Laos	8,000	23,625	21,000	52,625
5	Nam Theun	Laos	40,000	23,625	21,000	84,625
6	Se Bang Fai	Laos	20,000	23,625	21,000	64,625
7	Se Bang Hieng	Laos	30,000	23,625	21,000	74,625
8	Se Done	Laos	10,000	23,625	21,000	54,625
10	Nam Gam	Thailand	c/	23,625	21,000	44,625
11	(a) Lam Dom Noi	Thailand	12,000	23,625	21,000	56,625
	(b) Chaya Poum	Thailand	d/	b/	b/	-
19	Upper Srepok	Viet-Nam	d/	a/	21,000	21,000
25	Prek Thhnot	Cambodia	28,000	a/	21,000	49,000
26	Stung Pursat	Cambodia	12,000	a/	21,000	33,000
33	Stung Sen	Cambodia	14,000 e/	23,625	21,000	58,625
			300,000	189,000	231,000	720,000

Table 4

Estimated cost for detailed investigation and preparation of comprehensive report for the Nam Theun Project (Number 5) as recommended by the Japanese Team

1. Field investigation including geological boring	150,000
2. Preliminary design and report	150,000
Total	$300,000

a/ Provided under Japanese aid
b/ Installed and operated by Royal Irrigation Department
c/ Provided under Japanese aid
d/ Provided under Canadian programme
e/ Reservoir and irrigable area of Stung Sen only

The secretariat fully concurs with the recommendation of the Japanese Team that collection of basic data for the promising tributaries be initiated without delay. On some of these promising tributaries, stream gauging stations have already been established under the U.S. aid programme. Such stations, however, are not located at the proposed project (dam) sites but in the vicinity of the confluence of tributaries with the Mekong, and were established with a view to ascertaining the water potential of the tributaries in the entire lower basin. It is definitely not advisable to shift any of these stream gauging stations before years of continuous records become available. The secretariat is of the opinion that, with regard to the establishment of new stations, the Committee may seek assistance from cooperating countries for the supply of necessary equipment of an estimated cost of about $200,000. The riparian countries concerned would be responsible for maintenance and operation.

It may be noted that topographic maps on a scale ranging from 1:10,000 to 50,000 of the promising tributaries were compiled by the Japanese Team from aerial photographs made available to them (see list on page AP-II-22 to 24 of the Comprehensive Report). However, most of these maps on a scale of 1:10,000 do not cover the entire project area but only the dam sites. A few maps covering the entire reservoir project area are on a scale of 1:50,000 and are not sufficiently detailed for project planning. Moreover, the lack of ground control in the preparation of the maps also affect the desired accuracy. Therefore, the preparation of topographic maps on a scale of 1:20,000 for the reservoir and irrigable areas, and maps of 1:2,000 for dams and other structure sites, are necessary. As the aerial photographs of the areas under consideration are already available with the national agencies, it is hoped that mapping can be included in the respective national programmes.

/The Japanese

The Japanese Team further recommended that among these 9 promising tributaries, detailed investigation be carried out for the Nam Theun scheme. The Report indicated that the development of the Nam Theun would include seven projects on the Nam Theun proper and on its tributaries and also the diversion of flow into neighbouring streams. The secretariat feels that, before going into project planning of such a major system involving 1.7 million kilowatts of maximum power, it would be highly desirable to embark on a programme of systematic measurement of available water at every key project site and to defer project planning until several years continuous hydrologic data become available. The Japanese Team may be requested to prepare a detailed programme for the establishment of a network of hydrologic and meteorological stations and of measurements for the Nam Theun basin. The establishment of only one station in the entire project area, as recommended in the Report, may not be sufficient to serve the purpose of planning such a complicated system.

/II. DEVELOPMENT

II. DEVELOPMENT OF THE MAIN STEM

The objective of the reconnaissance survey, very competently undertaken by the team of experts organized by the Government of Japan, was to ascertain the potentialities of water resources development of the major tributaries in the Lower Mekong Basin. As the development of many of the major tributaries is intimately related to the development of main stem (for example the Nam Pong and Nam Mong projects would receive their flow from the Pa Mong reservoir), the Team also looked into related development in the main river. In fact, the development of the Mekong is such a challenging task to engineers with imagination that any one dealing with a part of it cannot lose sight of its tremendous possibilities in its entirety. The Team has in fact devoted considerable effort to the study of main stem projects which are only remotely related to the tributaries.

In its comprehensive report, the Team presented a revised scheme on the development of the main stem of the river.[1/] This revised scheme differs essentially from the one contained in ECAFE report[2/] in that two large storage projects are added to the system, namely: the Pak Beng project located 120 km upstream of Luang Prabang, with an effective storage of 20 billion m^3, and the Stung Treng project located just downstream of Stung Treng with an effective storage of 31 billion m^3. The Pa Mong dam, as suggested in the first reconnaissance report, would have its height increased from 40 to 80 metres to provide an effective storage of 38 billion m^3. The general layout of the revised scheme is shown in figure 1.

/With only

1/ See Chapter V of the Comprehensive Report, in particular table 21 facing page V-16 and figures V-F-1 and V-F-2

2/ ECAFE: Flood Control Series No. 12 "Development of Water Resources in the Lower Mekong Basin", 1957

With only the Pa Mong and the Stung Treng projects on the main stem and a few tributary storage projects in Laos located between Vientiane and Khemarat, which together would have a total effective storage of 85 billion m^3, it would be possible, according to the report, to keep the flood flow at Phnom-Penh to below 20,000 m^3/sec (water level 8.00) at all times and to maintain low water flow above 5,100 m^3/sec (water level 3.7 m). By diverting the flow from Stung Treng reservoir to the Stung Sen and subsequently to the Stung Staung, Stung Chkreng and Stung Sreng, over a million hectares of land north of the Great Lake could be brought under irrigation.

The proposals summarized above and related studies[1/] contained in the Report are studies related to "River Basin Planning". In fact, the "Five-Year Programme of Studies and Investigation", recommended by the Wheeler Mission and approved by the Committee calls for the preparation of a skeleton basin plan in the fifth year of operation after essential basic data (hydrology, geology, mapping, etc.) are available. Canada has undertaken to have all main stem topographic maps ready by the end of April 1962. The Harza Engineering Co. will soon complete the processing of hydrological data for all stations in the lower basin for the years 1959 and 1960 and will also be ready with compilation and analysis of past records taken before 1959. With these data available, to be supplemented by other investigations such as detailed mapping of sites, geological investigations, construction material surveys, and other agricultural and economic investigations, it should be possible to assess with certainty the desirable size of the projects and their optimum combination together with an estimate of costs and benefits. The detailed investigations being carried out or to be carried out at Pa Mong, Sambor and Tonle Sap will greatly facilitate the work towards the preparation of

/a basin plan.

1/ See Comprehensive Report, Chapter V - Suggestions on main stream projects; Chapter VII - General review of the development of the Mekong basin water resources, and Appendix IIIA - Study of after effects of development of the main stem and tributary project on the delta region.

a basin plan.

The Japanese Team has, with unequalled vision, presented in its report the possibilities of the development of projects on the main stem. However, it is not possible at present to pass any definite opinion on the proposals without first attempting to secure more hydrologic data, accurate topographic maps and other information. Suffice it to say is that the proposals definitely deserve very intensive further investigation, and provide very useful guidance for the preparation of a comprehensive plan for the entire lower Mekong basin.

The Committee has already embarked upon a programme of detailed investigation of three of the main stem projects, namely the Pa Mong, Sambor and Tonle Sap, under the main responsibility of respectively USA, Japan and India; and with considerable collateral support from inter alia Australia, France, New Zealand, UNESCO, and the UN Special Fund. One is often questioned as to the wisdom of having launched a programme of detailed investigation of certain projects without having first worked out a comprehensive basin plan.

A river basin is an integral organic unit and all projects in a basin will affect each other. One of the main objectives of a river basin plan is to coordinate the planning of all individual projects in such a way that the combined system will yield optimum benefits at the lowest cost for the largest number of people. This is normally done by comparison with other alternative projects and combinations. Theoretically, it is desirable to select a project for detailed investigation only after its exact position as related to other projects in a basin plan is quite well known. But in practice, the time and cost involved in the preparation of a basin plan make it impractical to wait for its completion before embarking on planning and investigation of single projects. On the other hand, one should not embark on the planning of any single project, if it is so

/obviously known

obviously known that development of such a project would preclude the possible development of better projects or would adversely affect the optimum development of the system as a whole. Very often a preliminary basin plan, giving a general orientation of the relation of projects with each other and with the basin as a whole, will meet the practical requirement. The question of how much ground a preliminary plan should cover is a matter of judgement. In an developing country, it is often imperative to initiate a development project, without an overall plan, provided that, after careful consideration of all known factors then existing, it may be concluded that such a development project would not adversely affect others.

Any basin plan, no matter how comprehensive it may be, is always subject to alterations and revision, as new data become available, new needs arise and new techniques develop. In 1957, on the basis of a preliminary plan prepared by ECAFE, the Committee assigned first priority to the detailed investigation of three main stem projects, namely Pa Mong, Sambor and Tonle Sap, and arrangements were made with cooperating countries to proceed with the investigations. In the light of the recent proposals contained in the Japanese Report covering main stem projects, the Committee may wish, no matter how preliminary the proposals are, to examine whether any adjustment of its programme of investigations would be desirable.

The Pa Mong dam is located at the exit of a gorge, below which the Mekong flows in an open valley for more than 350 km before it enters another gorge, the Khemarat. The Pa Mong is therefore a natural site for a storage dam that will not be affected by projects located downstream. The size of the Pa Mong project, or the height of the dam, will affect the location and size of the next project immediately upstream, somewhere between Pak Lay and Luang Prabang, but it will not,

/as far as

as far as the present knowledge of the area indicates, in any way have repercussions on other projects, and it will in no way obstruct other possibilities of superior development. Therefore, the secretariat believes there is no reason to hold up detailed investigation of the Pa Mong.

The Sambor project is the power dam located furthest downstream on the main river. The topographic maps of the dam site provided by Canada and supplemented by the Service Geographique Khmer show that it is not economically feasible to raise the present water level of 6 metres above MSL by means of a dam to more than 35 to 40 metres above MSL, as the embankments on the gentle sloping land on both banks would be too high and would have to be extended over too great a distance to reach higher ground. At this elevation of 40 metres above MSL, the backwaters can reach only below Stung Treng. Between Sambor and Stung Treng, there is no other choice than a low dam at Sambor with a limited height. From Stung Treng upstream, there are various alternatives of development such as (1) a series of low dams heading the flow to the foot of Khone Falls, (2) one medium size dam to head the flow to the foot of Khone Falls or (3) a high dam to submerge the Khone Falls. To develop this reach between Stung Treng and Khone, it will be necessary to investigate the various alternatives and possibilities which are certainly not limited to any one single combination.

As far as the Sambor site is concerned, physical conditions limit the choice of the site and restrict the dam height to below 35 or 40 metres above MSL. The river flow available for power generation as well as the maximum flood are the only variables that are dependent on the degree of regulation of flow by projects located upstream, which can be estimated and taken into account in planning. There is therefore no reason for holding up the detailed investigation of the Sambor project until a basin plan is available.

/The Tonle Sap

The Tonle Sap project was planned for moderation of flood flow in the delta. It may be argued that if the major main stem projects, notably the Pa Mong and Stung Treng, could provide sufficient storage to moderate the flood flow, it would not be necessary to have the Tonle Sap project at all. Thus it would follow that detailed investigation of Tonle Sap may be postponed until comparative studies of these alternative schemes are ready. This argument applies also to the delta model study to be started by UNESCO with Special Fund finance.

The Pa Mong project, located 900 km away from the delta, cannot replace the flood control function of the Great Lake, whenever flood producing typhoons cross the Indo-chinese peninsular downstream of Pa Mong, as is frequently the case. On the other hand, the Stung Treng reservoir, located near the head of the delta, appears to be in a position to compete with Tonle Sap for controlling the flood in the delta. A comparison of the two schemes, Stung Treng and Tonle Sap, would have to be based on their costs and benefits after checking the engineering feasibility. The lack of data does not permit any rough comparison to be made at present. On the basis of experience of flood control both inside and outside the region, it is quite evident that the detention of flood waters by means of an existing lake generally offers the cheapest means of flood control, as evidenced by the fact that a simple barrage at Tonle Sap, with a draw-down of 4 to 5 metres, would provide about 30 billion m^3 storage in the Lake, a volume comparable to the life storage of Stung Treng and Pa Mong. Even should further studies show that the Stung Treng reservoir could provide flood control in the delta at a cost less than that of the Tonle Sap project, the Tonle Sap can always serve the useful purpose of maintaining sufficient depth of water in the Lake for fish

/production.

production. It can further regulate the run-off from tributaries of the Great Lake into the Mekong[1/]. For this reason, the secretariat believes that detailed investigation of the Tonle Sap project should not be held up pendin further studies on the Stung Treng.

When examining the programme of studies and investigation as a whole, the secretariat concludes that detailed investigation of the three priority projects should be carried forward without delay. Concurrently with the programme of detailed investigation, work on the preparation of a skeleton plan for the entire lower basin should be initiated. Whereas a basin plan is an indispensable instrument in coordinating individual projects for optimum development of water resources in the basin, the detailed investigation of individual projects in turn provides the basic studies and analyses on the basis of which a proper basin plan is to be formulated. The secretariat plans to revise the preliminary plan prepared in 1957, as soon as the basic data become available, with a view to gradually developing it into a comprehensive plan, concurrently with the progress of the detailed investigation of the main river and tributaries projects undertaken by national agencies and cooperating countries.

/III. SECRETARIAT

1/ See footnote 1 on page III-A-18 of the Comprehensive Report

III. SECRETARIAT RECOMMENDATIONS

In the light of the above consideration, the secretariat makes the following recommendations:-

1. The Japanese Team of Experts, under the leadership of Mr. Y. Kubota, has completed in less than three years an excellent piece of work in the reconnaissance of the major tributaries. The Report prepared by the Team provides for the first time a comprehensive outline of the potentialities and opportunities of development of the tributaries, which are of vital importance for the development of the Lower Basin. The Committee may wish to record its deep appreciation of the work of the Team and thank the Government and people of Japan for this exceedingly valuable assistance given to the Committee in furthering the Mekong project.

2. Of the 16 promising tributaries[1/] recommended by the Team, 7 tributaries are currently under planning. It is recommended that collection of basic data be initiated for the remaining 9 tributaries. The work includes the establishment and operation (3 years) of hydrologic stations at an estimated cost of $420,000, and topographic mapping at an estimated cost of $300,000. The Committee may wish to seek outside assistance for the procurement of hydrologic equipment estimated at about $200,000, and to include the rest of the work under their own national programmes.

3. To prepare for the planning of a system of projects in the Nam Theun basin, the Japanese Team might be requested to prepare for the Committee a detailed plan for the establishment of hydrological and meteorological stations and topographic mapping.

/4. As much

1/ See tables 2, 3 and 4

4. As much further basic data on the basin will soon become available, e.g. topographic maps and hydrologic observations, it is recommended that the secretariat be authorized to proceed with the preparation of the basin plan. The secretariat may also be authorized to negotiate for assistance required both to secure additional data (such as detailed mapping) and to carry out necessary investigations (such as dam foundation investigations).

5. There should be no slackening of effort in planning and in the preparation of comprehensive project reports on the three main stem projects viz Pa mong, Sambor and Tonle Sap.

6. With a view to facilitating basin planning, it is recommended that riparian countries give highest priority in their national mapping programmes to these areas covered by projects, both on the Mekong main stem and on the tributaries.